LESSON: Design Process and Flowcharts	Time: 50 minutes

Overview:

Students were introduced to the design process during the remix project. This lesson formalizes the design process for students and gives them context into what it is and why they use it. The lesson introduces flowcharts and engages students in creating their own.

This lesson is only an introduction. Flowcharts and algorithms will continue to be emphasized in the missions and lessons.

Objectives:

- I can explain the design process
- I can define algorithm and flowchart
- I can use the correct flowchart symbols for a specific task
- I can create a flowchart that visually represents an algorithm
- I can create a flowchart from a Python program

Standards:

2-AP-10 Use flowcharts and/or pseudocode to address complex problems as algorithms.

2-AP-13 Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.

3-AP-13 Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.

CSP Framework:

Computational Thinking Practices:

1.B Determine and design an appropriate method or approach to achieve the purpose.

2.A Represent algorithmic processes without using a programming language.

Key Concepts:

- The **design process** is used in many professions.
- An **algorithm** is the steps to solve a problem.
- An algorithm can be represented visually by using a **flowchart.**
- There are many benefits to using a flowchart in the design process.

Preparation:

Make a copy of the assignment or put it in the LMS.
Slide 13 and 15 (see teaching tip below)
Prepare code snippets for students to make flowcharts from. This can be for individuals, pairs working together, or groups of three at the white boards.
Prepare any formative assessments you want to use in the wrap-up

Links:

- Assignment
- Instructions slide deck
- Big Bang Theory - the friendship algorithm
- Python code for flowcharts
- Python code answers
- Kahoot #4 (flowchart shapes)
- Review worksheet (digital)
- Review worksheet (print)

Resources:

- https://www.teachwithict.com/flowcharts.html#google_vignette
- https://blog.technokids.com/programming/how-to-make-a-flowchart-for-programming-easy-to-understand/

Agenda:

- Warm-up / Design process (5 minutes)
- Intro to flowcharts (15 minutes)
- Student examples (10 minutes)
- Python examples (15 minutes)
- Wrap-up & Assessment (5 minutes)

Vocabulary:

- **Design process:** a tool that helps you break down large projects into smaller, easier-to handle stages
- **Algorithm:** a sequence of steps for completing a task
- **Flowchart:** a diagram that uses shapes, lines, and arrows to sequence steps; a visual representation of the input, output, decisions, and actions that take place within a program

Assessment:
- Daily reflection journal or Google form (your link)   - Assignment completion and/or worksheet or quiz on the design process and flowchart shapes   - Ability to create a flowchart from Python code

Teaching Guide

Warm-up / Design Process (5 minutes)

This lesson can go long. I suggest doing what you can in one class period and doing the rest later if there is time after a shorter lesson, or not worrying about if they don't do them all because another lesson will follow where students are given a flowchart and write the code from it.

🧑‍🤝‍🧑 **Discuss** – Use a discussion strategy, like journaling, working at boards, selecting random students, or a form of think-pair-share.

💡 **Teaching tip**
- Ask the students to reflect on the steps they followed to complete their remix. Show slides 1-3
- Discuss how the steps they followed are the design process, used in many industries and professions. Show slides 4-6
- Include any student discussion about the design process that you feel needs to happen.
  - How it is used in other industries
  - How you might use it in everyday life or at school
  - Have the students re-create the design process chart on their own, discussing each step ([review worksheet-print](#) or [review worksheet-digital](#) -- the first half of each)

Intro to flowcharts (15 minutes)

💻 You can do this as a whole group, or with students working in pairs or groups of three

💡 **Teaching tip:**
Go through slides 7 and 8.

Show the Big Bang Theory youtube clip on flowcharts. Then show slides 10 & 11.

Show slide 12. Ask the students to improve the flowchart by adding input and output

Slide 13 and Slide 15 are activities for the students. (Slides 14 and 16 are answers). You can have the students work on them digitally on their computers, or you can project the slides and have the students recreate the flowcharts correctly on paper or small whiteboards. You could also have printouts and students can recreate at their VNPS. If students are working digitally, the easiest way is with Google Slides, because the symbols are easy to insert. Google Docs also can use the symbols; students need to go to Insert-Drawing and then use the symbols there before inserting.

Student flowchart examples (10 minutes)

Slide 17 – have students create their own flowchart examples. Suggestions are on the slide.

Python flowcharts (15 minutes)

💡 **Teaching tip:**
Show slides 18 and 19.

👫Talk about what kinds of input and output they have with the CodeX. What kind of actions or processes do they have?

💡 **Teaching tip:**
Slide 20 is an example with an if statement. Slide 21 shows a mapping of the code to the symbols. Look at the time you have left in the class period. If you have a lot of time, move forward with this example. If you are running short on time, skip this part and stay with simple Python examples for the class period. Another lesson is coming with flowcharts, and you can do this section later if you need to.

💡 **Teaching tip:**
You will do either Slide 22 or Slide 23 with the students, but not both.

Use slide 22 if you have students working in groups of three at vertical white boards (BTC). Get printouts from the samples on the [Python Code for Flowcharts document](). Students should not be required to do all of the samples, and should look to other groups to build classroom autonomy. [Flowchart answers]()

Use slide 23 if you are having the students work individually or in pairs at their desks.

✅ If you are having students work at the boards most of the time, they will not have an assignment to turn in. You can use the assignment document if you want, or use a review worksheet instead.

✅ If students are working individually or in pairs at their desks, have them complete the assignment and turn it in. Doing a review assignment is optional because they will already have answered the review questions on the answer document.

Wrap-Up (5 minutes)

The wrap-up can be very short for this lesson. Show slide 24, which has definitions for algorithm and flowchart. Have a discussion on anything you think students need to review for the day.

Formative Assessment:
- Daily reflection journal or Google form (use your link)
- Class discussion on what they learned about the design process or flowcharts
- Assignment completion and/or worksheet on the design process and flowchart symbols
  - [Assignment document]()
  - [Review Worksheet]() (for printing and completing)
  - [Review Worksheet]() (for completing online)
- [Kahoot #4]() -- or can be given after next lesson, also on flowcharts
- Programming journal (vocabulary only)
- Exit ticket

SUCCESS CRITERIA:

- ❏   Know the five steps in the design process in the correct order
- ❏   Know the symbols (or shapes) used in flowcharts, and what each shape is used for
- ❏   Create an accurate flowchart from Python code